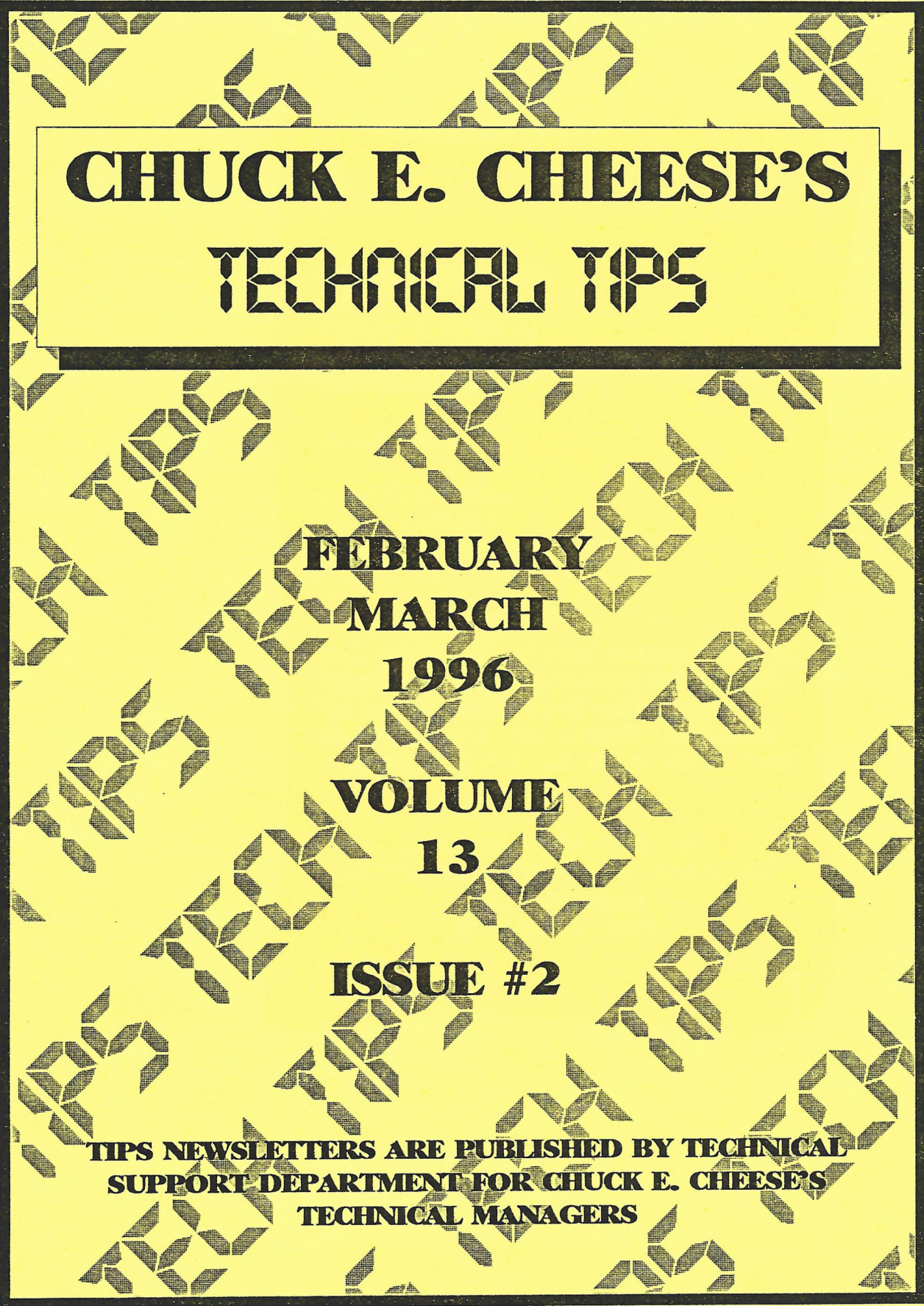




CHUCK E. CHEESE'S TECHNICAL TIPS

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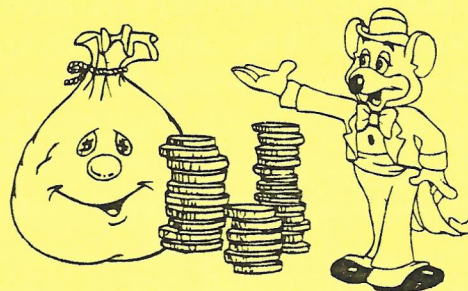
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WHAT'S HAPPENING IN THE WORLD OF PARTS

COST REDUCTION PARTS FOR SALE!!!

Due to the great demand, the Parts Department has been able to reduce the price of the CEC Car photo paper. The cost has been reduced from \$15.24 per roll to \$12.31 per roll. When ordering, please refer to Part #AMT-000! Look for more price reductions or parts specials in the next issue of tips.



CHARLIE WHITWORTH

It is unfortunate that we announce that Charlie has decided to go on disability. All of us will certainly miss the tremendous contributions he made. To give you a brief overview of his contributions, he began his career with the company on February 24, 1981 as a store technician in Tulsa, Oklahoma. Then, around January of '82 he moved to CA and worked as an opening/store technician in Dublin, CA. One of the many exciting things that he contributed towards was the commercials with Dick Van Patton. In December of 1983, he wanted to come to Dallas so Gene Cramm and Ron Hake made that possible; he worked at the Carrollton location as a store technician and assistant manager. Then, he went to Richardson as a store technician and on to Montfort as a store technician/master technician. After that, he went to the Irving location in 1988 to assist with the new store opening and worked as a store technician/area supervisor under Greg Barton. Charlie was off for 8 months due to illness; when he returned in April 1990, he began working at the corporate office in the Technical Support Department as a technical advisor. The one thing he was most proud of; in June of 1991, with assistance and a lot of overtime, he opened the Parts Department and became the Parts Department Manager under Farshid Khoshgam. Charlie was very dedicated to the company and was a hard worker; he still calls to check on us making sure everything is running OK. Charlie is a good person to work with and we'll all miss him.

CALCULATING SPEAKER SYSTEM LOAD IMPEDANCES

If you have had some problems with your amp failing and aren't sure what to check before putting in a new one, start with basics; ohm it out! Here's an article about load impedance that will be of great help:

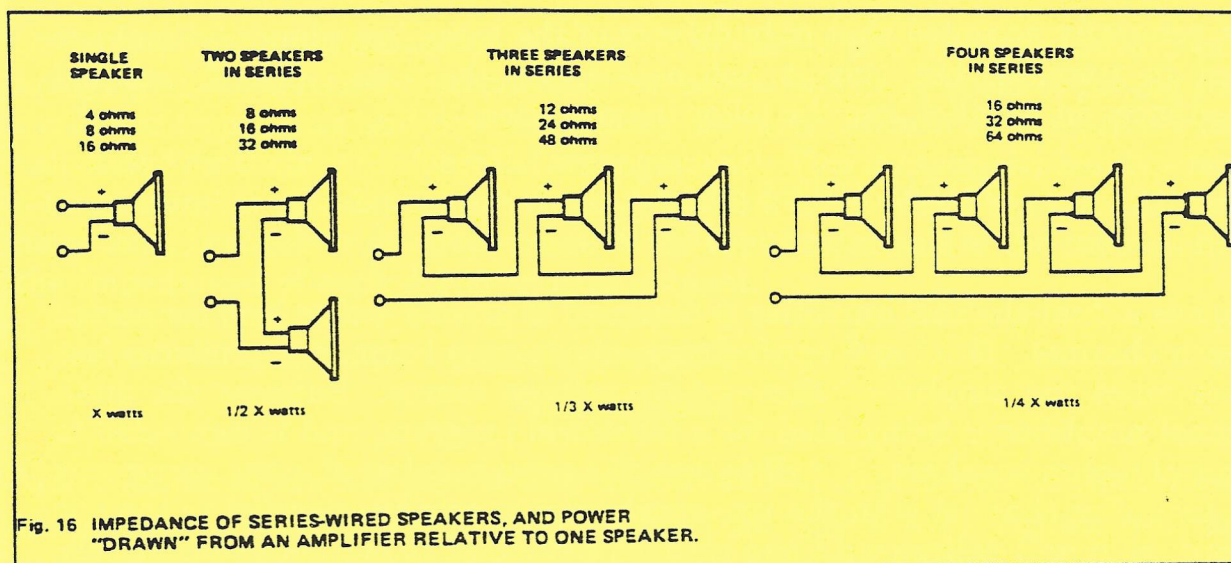
Several speaker components having the same power handling capability, sound dispersion angle, efficiency or other characteristic are often connected in groups to make a system that goes beyond the capability of the individual units in that system.

There are two basic ways to hook up speakers so that power is uniformly distributed and it remains relatively easy to calculate the resulting load on the amplifier. The easy way to figure how much power a group of speakers, or drivers, can handle is to multiply the power handling specification of one of the drivers by the number of drivers. That part of the process is always the same as long as all the connected drivers are identical.

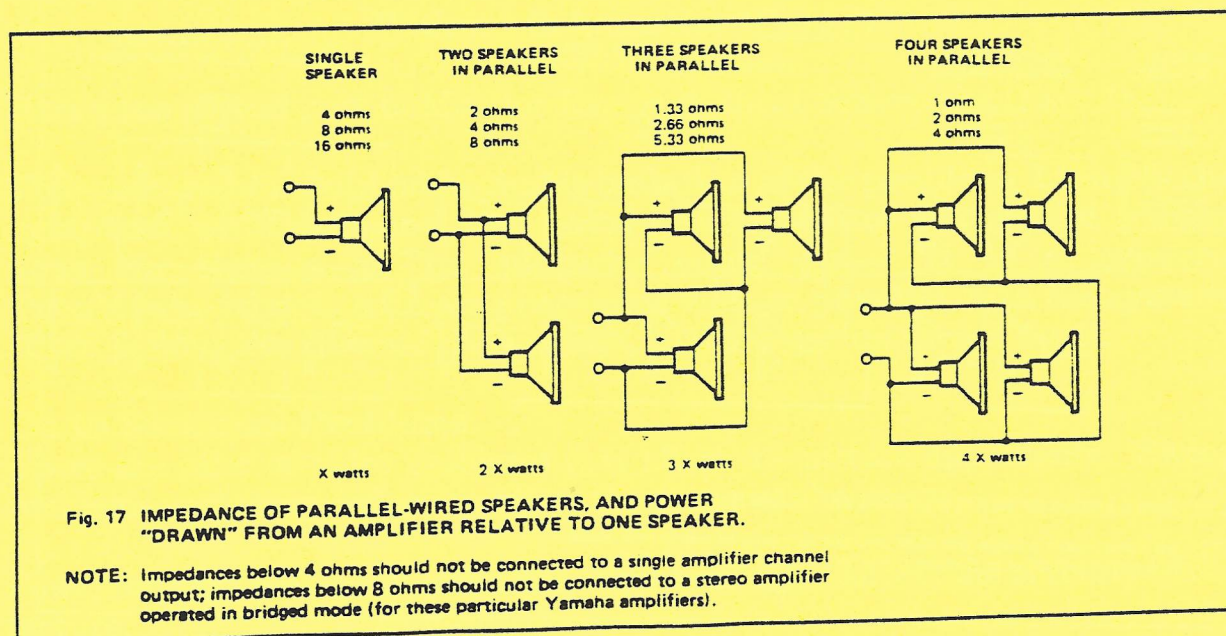
It is not recommended, nor is it common practice, to place different types of bass drivers in a single enclosure, or to connect different types of bass drivers in series, or parallel because the power will not be distributed evenly among the drivers. This same reasoning also applies to the connection of various systems which have different rated impedances.

A group of speakers that are connected in series presents a higher impedance to the amplifier than any one of them alone; the total impedance is the sum of the individual impedances. A higher total impedance represents a lesser load to the amplifier, and consequently draws (or receives) less power.

If all the speakers connected in series are the same impedance, then the total impedance is the impedance of one speaker multiplied by the number of speakers. The power delivered to any one speaker is the total power delivered to the group, divided by the number of speakers. For example, if four eight-ohm speakers are connected in series, the total load impedance is 32 ohms. An amplifier rated at 250 watts into 4 ohms would deliver $1/4$ that power, or about 63 watts, into 32 ohms. Thus, one of the four speakers would dissipate $1/4$ of that power, or just under 16 watts. (If the speaker impedances are dissimilar, the highest impedance driver receives the most power).



Speakers connected in parallel present a load to the amplifier that is lower impedance than the impedance of any one of the drivers. This represents a greater load to the amplifier, and also draws more power. Parallel wiring can be thought of as a pair of parallel wires where individual drivers are all connected across the two wires. If all the speakers are identical, then the total impedance of the array is simply the impedance of any one of the drivers divided by the number of drivers. For example, three 16 ohm drivers connected in parallel represents a total load impedance of $16/3$, or 5.33 ohms. Connected to an amplifier rated at 250 watts into 4 ohms, this load would draw about 188 watts. Thus, one of the four speakers would dissipate $1/4$ of 188, or about 47 watts. In this case, the parallel wiring results in greater overall power delivered to the speakers.

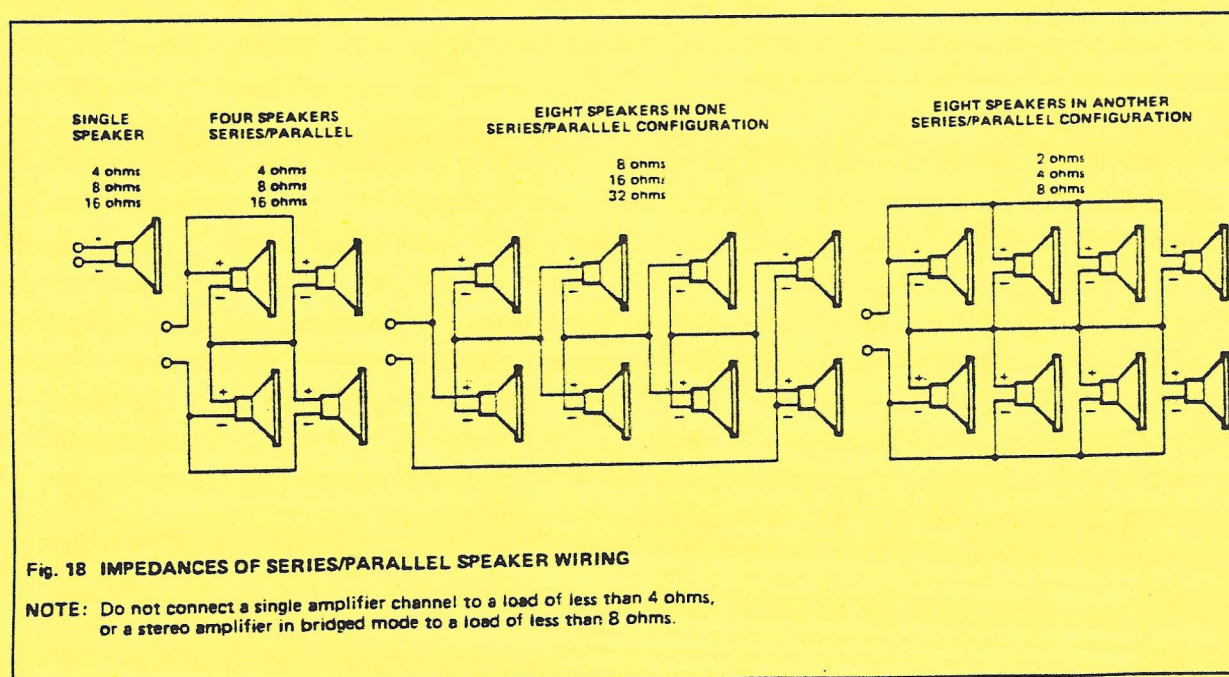


It is generally accepted that only drivers of the same impedance (ohms) are wired in parallel, but this is not necessarily the case. For 2 unequal impedances in parallel, use the following equation:

$$\text{TOTAL OHMS} = \frac{(a \times b)}{(a + b)}$$

Suppose a dual-channel amplifier is designed to drive a 4-ohm load connected to each channel. Driving 8 or 16 ohm loads does no harm, but produces less power since the amplifier behaves as a voltage source. Suppose the dual-channel amplifier is being used for a monaural program, and is connected to a pair of 8-ohm speakers. It will deliver the same number of watts using only one amplifier channel with the two speakers connected in parallel to the one output, as it will deliver with one speaker connected to each of two channels.

Theoretically speaking, any combination of parallel and series wiring is permissible in a speaker array as long as it results in the distribution of the same amount of power to each driver in a given system. Practically speaking, though, speakers that are connected in series do not perform the same as those connected in parallel. In simple terms, the reason is that the speakers connected in series operate with a worse effective damping factor than those connected in parallel. This can result in somewhat degraded bass performance. Furthermore, if any one speaker in a series circuit fails (open-circuit), the rest of the speakers connected in series with it will cease operating. For these reasons, it is generally better to use parallel connection for multiple speakers.



Once you have interconnected a group of speakers in a single enclosure (an array), you can consider that enclosure to be a single large speaker having the combined impedance and power handling characteristics of all the drivers (as calculated for their series/parallel arrangement). This is especially handy when a large number of cabinets are combined into a huge sound system. All you have to do is consider the impedance at the input terminals of the cabinet, not the impedances of each driver in each cabinet.

BEST OF CEC TV 93 (GENERIC)

Many locations are not sure if they should still have this tape in their video library, the answer is YES YES YES! This tape is not a replacement for your current show tape, but should be used in case of failure or damage to the current show tape. This will allow you to order a new current tape without any down time or inconvenience to our guests. With this in mind, check your library and make sure you have the Best of CEC TV (Generic) tape in your library. If you have any questions, feel free to contact the Technical Support Department at 214-258-5545.

INPUT TO TIPS

Attached, please find an Input to Tips form that should be used when sending information to the Tech Tips publication. If we use the information sent, your name will appear on the contributors list.

MONITOR REPAIR Without Schematics (Part 2)

Here's the second part of Monitor Repair Without Schematics (Part 2):

The essence of troubleshooting is isolation of the problem. Identify the symptom, what does and does not work. A monitor is a system. Power goes in, signals go in, pictures come out. It is a process. Troubleshooting is a linear process as well, in parallel with the system. If we follow the flow of the system, it will lead us to the fault.

On to Sectional Problems.

There are color or video problems that affect the picture appearance. Sweep problems including deflection affect the shape of the image.

Power supply trouble can affect the other two. Sync affects the stability of the picture.

A good waveform there probably means picture tube problems, but check for waveform at the CRT socket to be sure. An open transistor will leave the collector stuck at the video supply voltage, typically 100 to 200 Vdc. Also, sometimes called video B+ by us old timers, this supply should be clean. Any hash on this video B+ line means a bad filter cap on the supply. You will find each color gun driver transistor has a load resistor, probably a 1 or 2 watt size or so, between collector and video B+. Thus the three resistors will have one end common (connected to the same trace). **The common point is the Video supply line. A washed out picture that is hard to darken is probably due to bad filtration here.** The filter cap may be right on the neck board or on the main board. Look for 10 ufd or more, probably at 250V. Not sure which cap it is and you're having trouble following the traces? Use your scope to look at what is on the filter caps around the board. With the exception of the vertical output cap, you should expect to see smooth DC on them. If you don't, the cap is probably bad.

If the base of the driver has no signal, trace backwards through the circuitry by looking for waveforms at transistor leads and comparing to the other two color circuits. My experience has been that color woes are due to driver transistors first and CRTs (picture tubes) a close second. **If the problem is in the**

signal portion of the circuit, the most likely culprit is the one closes (electrically) to the input. Get yourself a CRT tester/rejuvenator, even an older one, and use it. My old and utterly basic Heathkit model works great. It is simply amazing how many tubes can be saved and how few cannot. A few hundred dollars may sound like a lot for a piece of test gear, but save just a few CRTs and it has paid for itself.

The neck board, that little PC board with the CRT socket, is often silk screened with CRT pin identifications. These are real helpful. K means cathode, so KR or RK refers to the red gun cathode, KG is green, you figure out blue. Filaments are labeled F or H for heater. One side of the filament is often ground. G1 and G2 are grids 1 and 2.

Vertical Section

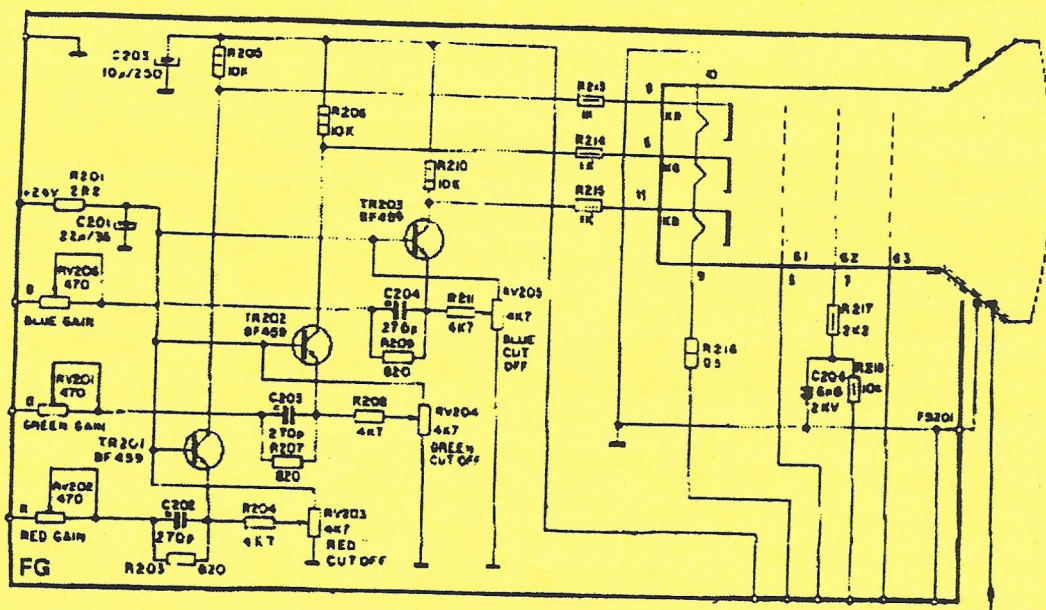
Vertical deflection or sweep problems are most often solved with capacitors. Anyone who uses "get well" kits for their monitors knows that changing caps can cure a boatload of symptoms. Of course, if you can't identify a monitor, you can't buy a kit for it. What you can do is identify the caps in the vertical circuit and change them, or at least scope them out and change the leaky ones. Vertical sweep circuits tend to fall into two categories: high voltage (over 100 volts, typically the same as the main supply) and low voltage (25 to 30 volts or so). First,

Color and Video Problems

Color problems have the built in advantage of multiple circuits. There are three color circuits so you can compare readings and waveforms between them. If a color is missing or stuck on full, suspect the driver transistor on the neck board. Drivers are generally in a TO126, TO220, TO202, or similar tab top case. Smaller case types generally contain signal transistors, know the power types the color guns need. Look at these transistors with your scope, comparing the good color with the bad color. If the signal on the base of the bad color driver is about the same as the others, then look at the collector.

Color Gun & CRT Circuit:

Note filter cap on video B+ line at the common end of the transistor collector load resistors. Failure of this cap results in overbright picture with poor contrast. Resistors in series with CRT cathodes protect the circuits in the event of high voltage shorts within the tube.



find the vertical output devices(s), whether special IC or just a pair of transistors, and see what kind of voltages you find there. This helps tell you what kind of caps to be looking for. Check the filter and bypass caps, probably 10 ufd or higher. **Sweep is generated by charging and discharging a cap through the vertical yoke.** Thus, output cap needs to be much larger in the low voltage circuits to provide the same level of energy to the yoke, so we look for 1000 ufd or more rather than 100 ufd or less you might find a higher voltage circuit.

The above caps tend to cure the foldover and lack of size problems. The smaller value caps (under 5 ufd) may be more likely associated with stability symptoms. Look for caps small in both size and value when chasing away a jittery picture.

Horizontal Section

The horizontal section offers different challenges. Deflection problems can be simple. In most monitors, the horizontal sweep section also generates many of the operating supply voltages, so it has to be working for the thing to even light up at all. **If you find a monitor with a bright vertical line and no horizontal deflection, there are only a few things it could be.** Usually, the pulses at the collector of the HOT are routed through width and linearity coils to the yoke. A lack of sweep here means one of those devices is open or the connections to

them have failed. Check the solder around anything that looks like a coil. I am sure it happens, but I have not replaced a yoke in over twenty years. If you think the yoke is bad, check the wiring first.

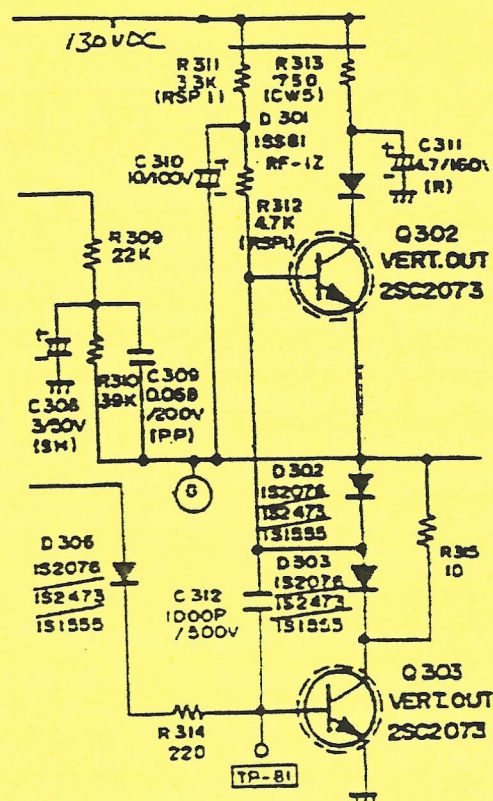
Pincushion is the term for a picture with the sides curved out or in, not straight. A pincushion problem will be stable. If the sides of your picture have a wiggle that moves up or down, you have a bad filter somewhere, not a pincushion problem. Pincushion correction circuits are often based upon a small transformer. They all look pretty much the same to me. Look at one in a monitor you know, then identify the similar thing in your repair unit. The usual problem will be the electrolytic cap or caps related to this transformer. This was a common problem on the Electrohome G07 and the Wells 4600 series. Some techs call the pincushion "keystone."

Blank Screen

If the monitor doesn't blow fuses, but otherwise appears dead, we start with the power supply. **If the main DC supply is absent nothing else will work.** Check for raw supply, i.e. the AC line rectified and filtered. This 160 Vdc should appear at the input to the voltage regulator IC or on one side of the pass transistor in a discrete regulator. If no raw supply, check for solderwork, open traces in the AC line, fuse, or current limit resistor (a power resistor of low

resistance value in the line with the bridge). Eyeball schematics are easy here. If this voltage is on the input of the regulator but no output is present, replace the regulator IC or check all the semiconductors in the regulator circuit.

When the sweep sections are not running, nothing else runs, so the load on the power supply disappears. Under these conditions, the main supply in some monitors can rise to the level of the primary supply: 160 Vdc or thereabouts. If the power supply fails and produces that high voltage even under load, the sweep sections will shut down for safety. We need to decide if the failure is regulation or shutdown. Plug your monitor into a variac. You all have one by now, right? Watch the main supply, the output from the regulator, a.k.a. B+, while you dial down the AC line until the supply drops to what it should be, say 130 volts. Leave it sitting there; power down for a few seconds to reset the shut down circuit, then turn it back on at the reduced line level. If the monitor now comes alive, the problem is a lack of regulation in the power supply or hash on the supply line. Scope the line and replace the appropriate filter cap if the DC is not clean. Check the regulator semiconductors and replace as necessary. I have to replace far more caps than regulators. If the unit still won't fire up, then you have a problem in the horizontal circuit or a bad shutdown circuit. Trace back from



Portion of Vertical Output CKT
Output comes from point "G" through yoke windings then through large value cap. (Yoke, cap, etc. not shown).

Failure of the filter cap at the collector of the upper transistor causes foldover problems. The other electrolytic caps would be suspects in sweep stability, size or linearity problems.

the HOT base, looking for drive signal. The base drive transformer and the driver transistor should be easy to find. The oscillator IC should be identifiable, see if it has any supply and if so, any output activity. Beyond that, it is a matter

of how much patience you wish to apply.

There is an old rule of thumb that says, "if the filament is lit, then the monitor is working." While this is often true, there is obviously a lot more to monitor repair. **If the horizontal sweep is running, just bringing your scope probe within a foot of the flyback will pick up the signal.** If the flyback is happening and there is no lit filament, check the wiring and solder to the CRT socket filament connections.

Some symptoms only show up after the unit has warmed up. A monitor runs a lot cooler on your bench than it does in a closed up video game cabinet. If this difference affects your symptom, cover the unit with a towel or packing blanket. This will hold in the heat and warm the unit. It is not likely to catch fire, but I wouldn't leave it running unattended and go to lunch. Thermal symptoms usually yield to the hot and cold approach, the electronic version of good cop, bad cop, I guess. If some function fails after warm up, locate the related area of circuitry on the PC board, and spray it with freeze spray. That's what the stuff is for. Hopefully, the symptom will immediately correct itself until it warms up again. If that works, you can direct your spray to specific components. A piece of cardstock or a business card can be used to keep cooling spray within an area or

away from other components. Remember, isolate the problem. A heat gun or a hair dryer in a pinch can be used to heat an area if you don't want to wait for it to do it on its own.

These approaches to troubleshooting are ones I would use to service any monitor, schematic or no, but it is important to realize you have the ability to do the job even without good documentation. These are just general suggestions and rules of thumb. Obviously many situations can arise that I have not covered. From time to time in my career in troubleshooting a system, I have traced the symptom all the way through a unit and right on out the input connections, thus proving that the unit was working perfectly well, the problem then being elsewhere. At first I felt like I had just wasted my time, but **troubleshooting skills will get you past a lack of schematics a lot better than schematics will carry you through a lack of troubleshooting skill.**

Good Luck!



Monitor Repair Without
Schematics
Points Covered

Part 1

Intro, troubleshooting philosophy, general approach, cautions. Three types of problems described:

- Monitor blowing fuses
- T'shooting horiz section
- T'shooting power supply

Line filter. Isolation problems. Discussion of approaches to locating and identifying components and circuits:

- PC board art
- Silk screening
- Component types
- Literature resources

Part 2

Color/Video problems:

- Color gun circuits
- CRT
- Neck board

Vertical section. General discussion on capacitors: High and low voltage circuit types. Horizontal section. Horizontal deflection - it ain't the yoke. Pincushion.

"Dead" monitor or blank screen: No power. Bad power or poor regulation and associated techniques.

Shutdown: Oscillator techniques. Heat related problems.

INPUT TO TIPS

Name:

Location:

Telephone #:

Problem:

Recommended Fix:

Parts/Materials/Supplier/Cost:

**Please attach schematics, drawings,
pictures appropriate.**